IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re:	Jeffrey A. Korn	Confirmation No:	9810
Serial No:	09/707,710	Group:	2871
Filed:	November 7, 2000	Examiner:	Wang, George Y.
For:	System and Process for Post Alignment Polarization Extinction Ratio Compensation in Semiconductor Laser System		
Customer No.:	29127		
Attorney Docket No.	1029us		

APPELLANTS' BRIEF

VIA FACSIMILE: **703-872-9306**
Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450,
Alexandria, Virginia 22313-1450

Sir:

This is the Applicants' appeal from the final Office Action, mailed May 18, 2004 (Paper No. 050504). A one-month extension of time is requested.

Real Party of Interest

Axsun Technologies, Inc. is the real party in interest.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 6-8 and 10-19 are pending in this application. Claims 6-8 and 10-19 stand finally rejected pursuant to the outstanding final Office Action.

Status of Amendments

All amendments have been entered. There were no post final amendments or proposed amendments.

As of May 18, 2004, the Examiner could not find in the Application the formal drawings filed by Applicants on February 20, 2001. Substitute drawings are filed simultaneously with this brief.

Summary of Claimed Subject Matter

Hereinafter, "Specification" refers to the Application's specification as amended on September 18, 2002, "Claims" refer to the claims as provided in the Appendix to this Brief, and "Figs." refer to the formal drawings filed herewith.

The present invention is directed to a method for controlling a polarization extinction ratio (PER) of a semiconductor laser system (Specification, page 4, lines 9-14). The polarization extinction ratio is a measure of the polarization of light (Specification, page 2, lines 5-9). Highly polarized light is important to the proper functioning of many optical systems (Specification, page 2, line 10, and page 3, line 9).

The light emitted from semiconductor lasers is typically highly polarized. Polarization-maintaining fiber is used to transmit the polarized light to the optical system. In order to ensure that the light reaches the optical system in its polarized state, the polarization maintaining fiber must be rotationally aligned to the semiconductor laser. Specifically, the polarization maintaining fiber works by transmitting light along either a fast or slow axis, which axes extend in a plane that is perpendicular to the longitudinal axis of the fiber. The high polarization extinction ratio is achieved by aligning one of these axes to the polarization of the light emitted from the semiconductor laser. (Specification, page 1, line 23, - page 2, line 19).

In the past, this alignment was achieved by detecting the polarization extinction ratio of the light emitted from the polarization maintaining fiber, and then rotationally aligning the fiber endface to the laser until the polarization extinction ratio was

maximized. The fiber endface was then soldered relative to the semiconductor laser (Specification page 3, line 15 – page 4, line 3).

The problem with this approach was that the process of securing the fiber endface in proximity to the semiconductor laser yielded: 1) slight shifts in the rotational position of the fiber endface and 2) mechanical stresses on the fiber that affected the polarization axes. These effects were due to the shifts that occur when the solder cools (Specification page 4, lines 4-10).

The present claimed invention seeks to solve this problem by first securing the fiber endface 126 in proximity to the semiconductor laser 114. After the fiber endface 126 is secured, it is rotationally aligned relative to the laser 114, in order to optimize the polarization extinction ratio. In the preferred embodiment, this is achieved by plastically deforming the mounting structure 104, which is used to hold the fiber endface 126 in proximity to the semiconductor laser 114. See Fig. 7 and Specification page 10, line 24 – page 11, line 15.

In short, the present invention is directed to first securing the fiber 106 to a mounting structure 104 and then deforming this structure 104 to rotationally align the fiber's endface 126 to achieve the desired polarization. This accounts for rotational shifts of polarization occurring during the securing of the fiber 106.

Grounds of Rejection to be Reviewed on Appeal

Whether Claims 6-8 and 10-19 are unpatentable or obvious over U.S. Patent No. 4,673,244 to Miles (hereinafter, "Miles Patent"), in view of U.S. Patent No. 6,340,831 to Kuhara et al. (hereinafter, "Kuhara Patent"), and U.S. Patent No.6,345,059 to Flanders (hereinafter, "Flanders Patent").

Argument

Independent Claim 6 is not unpatentable or obvious over the Miles Patent, Kuhara Patent, and/or Flanders Patent.

Independent Claim 6 of present Application requires "**securing an endface of an optical fiber** to the bench . . . **using a mounting structure**", and "**<u>after</u>** the step of **securing the endface** to the bench, detecting a polarization extinction ratio . . . and **axially rotating the endface** of the fiber relative to the bench to improve the polarization extinction ratio **by deforming the mounting structure**." In short, the fiber's endface is secured to the bench by a deformable mounting structure and, <u>subsequently</u>, the secured fiber's endface is rotated with respect to the light source.

Claim 16 of present Application provides more specifically that the "securing the endface of the optical fiber to the bench" using a mounting structure comprises "bonding the optical fiber to" the "mounting structure."

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). See also MPEP 2143.03 (May 2004).

A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997). See also MPEP 2144.05.III (May 2004).

It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). See also MPEP 2145.05.X.D.2 (May 2004).

The Miles Patent describes a method of aligning an end of a polarization-preserving optical fiber for attachment to a linearly polarized (plane polarized) semiconductor laser (col. 1, lines 11-15). A fiber end is arc-fired and epoxied into a metal ferrule (col. 3, lines 41-42). The ferrule is rotated and otherwise manipulated together with the fiber rigidly encased in it (col. 3, lines 48-52). When the fiber is aligned within the desired tolerance, all that remains is to attach the fiber to the laser

disposed atop a pedestal platform (col. 5, lines 24-29). The ferrule is bonded to a submount platform using an epoxy or a solder to secure the fiber tip in the correct alignment with the laser chip (col. 5, lines 30-35). After the bonding is set, the fiber is no longer adjusted.

The Miles Patent and the Applicants' invention both seek to improve rotational alignment between a fiber secured on a mounting structure and a laser. However, the Miles Patent does not show or suggest axially rotating the endface of a fiber secured to a deformable mounting structure by deforming the mounting structure, as claimed in Claim 6 of present Application. In fact, to optimize the alignment, the Miles Patent relies on absence of rotation of the secured fiber and on absence of deformability of the mounting structure. Thus, in some sense, the Miles Patent teaches away from the invention claimed by Applicants.

The Flanders Patent does show alignment of a fiber endface 122 using a deformable mounting structure 210.

But, the Flanders Patent does not contain any mentioning of polarization extinction ratio.

The Flanders Patent does not show or suggest axially rotating the endface of the fiber relative to the bench to improve the polarization extinction ratio by deforming the mounting structure, as claimed in Claim 6 of present Application.

The Kuhara Patent also does not show or suggest axially rotating the endface of a fiber relative to a bench to improve the polarization extinction ratio by deforming a mounting structure, as claimed in Claim 6 of present Application.

To summarize, the Miles Patent, Kuhara Patent, and/or Flanders Patent, alone or in a combination do not teach or suggest the step of Applicants' Claim 6 of "axially rotating the endface of the fiber relative to the bench to improve the polarization extinction ratio by deforming the mounting structure" performed after the step of

"securing an endface of the optical fiber to the bench to receive light generated by the semiconductor chip using a mounting structure."

Furthermore, the Miles Patent teaches away from the invention claimed by Applicants and teaches away from combining the Miles Patent with any reference teaching the following elements of Applicants' Claim 6: rotating the endface of a secured fiber or deforming the fiber mounting structure.

Applicants respectfully believe that the arguments of the final Office Action are not based on a fair interpretation of the Miles Patent.

In particular, the last sentence of the second paragraph of page 3 of the final Office Action reads (emphasis added): "Miles also teaches a process of securing the fiber on the mounting structure by sealing around the fiber, **before or after** axial rotation adjustments (col. 5, lines 39-51)."

Claim 6 includes the limitation of securing the fiber on the mounting structure **before** axial rotation adjustments. The Miles Patent does teach securing the fiber **after** the adjustments. Applicants' Claim 6, Specification and the Miles Patent consider securing the fiber to be over after the bonding material is set.

Column 5, lines 30-51, of the Miles Patent, whence the Examiner claims the teaching of securing the fiber **before** the adjustments, read:

> *Once alignment is completed, ferrule 110 is bonded to submount platform 140 using any suitable bonding material. The bonding material may be an epoxy or if the fiber is metallized it may be a solder. This secures fiber tip 160 in the correct range from, and alignment with, laser chip 120. If desired, the coefficients of thermal expansion of fiber and solder bonding material may be matched to prevent displacements caused by changes in temperature.*
>
> *It is possible that the bonding material 150, while setting up, may move ferrule 110 out of its aligned position. To compensate for this effect, transmission through fiber 10 may be monitored during the setting-up period, and slight correcting adjustments made to the position of ferrule 110. This permits*

> *permanent alignment of fiber and laser with only a few percent losses in extinction ratio during curing. Depending on the bonding material used, laser-to-fiber coupling can remain high over a reasonable temperature variation. For most epoxy bonds, this range could be 10° C. With metallized bonds, it is possible to maintain coupling over 25° C.*

As may be seen from the above quote and contrary to the Examiner's statement, the Miles Patent does not teach the limitation of Claim 6 of adjusting the fiber **after** securing the fiber, i.e. after the bond is set.

For the foregoing reasons, Applicants respectfully believe that the final Office Action, mailed May 18, 2004, does not established a *prima facie* obviousness of the claimed invention, that the pending obviousness rejections should be withdrawn, and that the present application should be passed to issue. Should any questions arise, please contact the undersigned.

Respectfully submitted,

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Claims Appendix

1. (cancelled)

2. (cancelled)

3. (cancelled)

4. (cancelled)

5. (cancelled)

6. A process for manufacturing a semiconductor laser system, the process comprising:
   installing a semiconductor chip in a package on a bench;
   inserting a polarization-maintaining optical fiber through a fiber feedthrough into the package;
   securing an endface of the optical fiber to the bench to receive light generated by the semiconductor chip using a mounting structure;
   after the step of securing the endface to the bench, detecting a polarization extinction ratio of light transmitted through the fiber from the semiconductor chip; and
   axially rotating the endface of the fiber relative to the bench to improve the polarization extinction ratio by deforming the mounting structure.

7. A process as claimed in claim 6, further comprising aligning the endface to the semiconductor chip.

8. A process as claimed in claim 7, wherein the step of aligning the endface to the semiconductor chip comprises energizing the semiconductor chip and monitoring a magnitude of light coupled into the optical fiber.

9. (cancelled)

10. A process as claimed in claim 8, wherein the endface is secured after the aligning step.

11. A process as claimed in claim 7, wherein the step of aligning the endface to the semiconductor chip comprises

energizing the semiconductor chip and monitoring a magnitude of light coupled into the optical fiber; and

positioning the endface relative to the semiconductor chip to maximize the magnitude of the light coupled into the optical fiber.

12. A process as claimed in claim 6, further comprising securing the fiber in a ferrule surrounding the fiber in the feedthrough.

13. A process as claimed in claim 6, wherein the step of detecting the polarization extinction ratio of light transmitted through the fiber comprises detecting a magnitude of light transmitted along a slow axis of the polarization-maintaining optical fiber and detecting a magnitude of light transmitted along a fast axis of the polarization-maintaining optical fiber, from the semiconductor chip.

14. A process as claimed in claim 6, wherein the step of axially rotating the endface of the fiber comprises plastically deforming a mounting structure that secures the optical fiber to the bench.

15. A process as claimed in claim 6, wherein the step of axially rotating the endface of the fiber comprises:

deforming a mounting structure that secures the optical fiber to the bench until a desired polarization extinction ratio is detected; and then

further deforming the mounting structure such that when released, the mounting structure will hold the fiber in an orientation corresponding to the desired polarization extinction ratio.

16. A process as claimed in claim 6, wherein the step of securing the endface of the optical fiber to the bench comprises bonding the optical fiber to a mounting structure.

17. A process as claimed in claim 16, further comprising sealing around the fiber in the feedthrough.

18. A process as claimed in claim 17, wherein the step of sealing around the fiber is performed before the step of axially rotating the endface of the fiber to improve the polarization extinction ratio.

19. A process as claimed in claim 17, wherein the step of sealing around the fiber is performed after the step of axially rotating the endface of the fiber to improve the polarization extinction ratio.

Evidence Appendix

None

Related proceedings appendix

None